# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-189263
(43)Date of publication of application : 05.07.2002

---

(51)Int.CI.
G03B 33/12
G02B 3/00
G02B 5/04
G03B 21/00

---

(21)Application number : 2000-388800
(22)Date of filing : 21.12.2000
(71)Applicant : SEIKO EPSON CORP
(72)Inventor : SAKATA HIDEFUMI

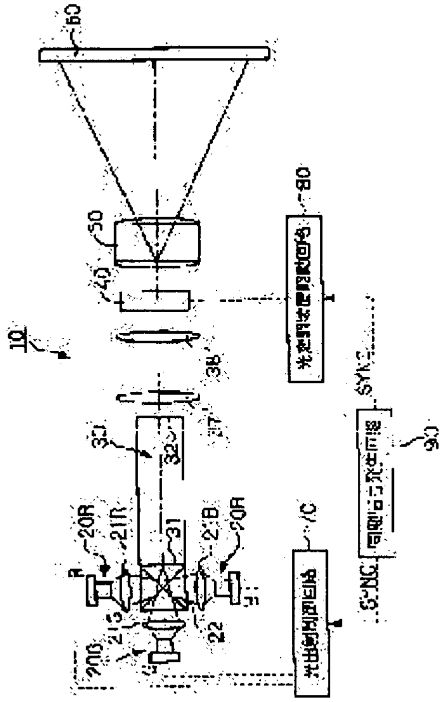
---

## (54) PROJECTION TYPE DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a projection type display device which can be miniaturized and whose display quality is excellent by uniformizing the illuminance (luminance distribution) of color light radiated to an optical modulator.

SOLUTION: This projection type display device 10 is equipped with light sources 20R, 20G and 20B respectively emitting a plurality of different color light beams, one rod lens (illuminance uniformizing means) 30 uniformizing the illuminance of the respective color light beams emitted from the respective light sources 20R, 20G and 20B, a light guide means 22 guiding the respective color light beams emitted by the light sources 20R, 20G and 20B to the rod lens 30 and one optical modulator 40 modulating the respective color light beams whose illuminance is uniformized by the rod lens 30. The color light beams are time-sequentially emitted from the light sources 20R, 20G and 20B, and the optical modulator 40 is time-sequentially driven corresponding to the color light beams emitted from the light sources 20R, 20G and 20B so as to synthesize a color image.



---

LEGAL STATUS
[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

**Japan Patent Office is not responsible for any damages caused by the use of this translation.**

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

## CLAIMS

---

[Claim(s)]

[Claim 1] Projected type display characterized by providing the following. Two or more light sources which can carry out outgoing radiation of the different colored light, respectively. One illuminance equalization means for equalizing the illuminance of each colored light by which outgoing radiation was carried out from two or more aforementioned light sources. A light guide means to lead each colored light by which outgoing radiation was carried out with two or more aforementioned light sources to the aforementioned illuminance equalization means. While providing one light modulation equipment which modulates each colored light by which the illuminance was equalized by the aforementioned illuminance equalization means The optical outgoing radiation control means which the timing which carries out outgoing radiation of the colored light from each light source is controlled, and can carry out outgoing radiation of the colored light one by one time from two or more aforementioned light sources, The light modulation equipment driving means which are made to correspond to the colored light by which outgoing radiation is carried out from each light source, and drive the aforementioned light modulation equipment one by one time, A synchronizing signal generating means to generate the synchronizing signal which synchronizes the timing which carries out outgoing radiation of the colored light from each light source, and the timing which drives the aforementioned light modulation equipment, and to input into the aforementioned optical outgoing radiation control means and the aforementioned light modulation equipment driving means.

[Claim 2] Projected type display according to claim 1 with which the aforementioned illuminance equalization means is characterized by the bird clapper from a rod lens or the fly eye lens of a couple.

[Claim 3] Projected type display according to claim 1 or 2 with which the aforementioned light guide means is characterized by the bird clapper from a dichroic prism.

[Claim 4] Projected type display given in any 1 term from the claim 1 to which colored light by which outgoing radiation is carried out with two or more aforementioned light sources is characterized by being red light, green light, and a blue glow to a claim 3.

---

[Translation done.]

* NOTICES *

**Japan Patent Office is not responsible for any damages caused by the use of this translation.**

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to projected type display.
[0002]
[Description of the Prior Art] Image light is compounded using liquid crystal equipment etc. as light modulation equipment, and the projected type display which carries out expansion projection of the compounded image light through the incident-light study system which consists of a projector lens etc. at a screen is known. The structure of the conventional projected type display is explained based on drawing 6 . Light modulation equipment and 825 show a dichroic prism, and, as for a dichroic mirror, and 815, 816 and 817, 826 shows an incident-light study system for the light source with which 810 consists of lamps, such as metal halide, in drawing 6 , and 813 and 814, as for a reflective mirror, and 822, 823 and 824.
[0003] A dichroic mirror 813 has the property to reflect a blue glow and green light, and it is reflected by the reflective mirror 817 and it carries out incidence of the red light which penetrated the dichroic mirror 813 among the light by which outgoing radiation was carried out from the light source 810 to the light modulation equipment 822 for red light while it penetrates red light. On the other hand, among the colored light reflected with the dichroic mirror 813, it is reflected by the dichroic mirror 814 which reflects green light, and incidence of the green light is carried out to the light modulation equipment 823 for green light, and after also penetrating a dichroic mirror 814 and being reflected by the reflective mirrors 815 and 816, incidence of the blue glow is carried out to the light modulation equipment 824 for blue glows. Incidence of the three colored light modulated by each light modulation equipment is carried out to a dichroic prism 825, three colored light is compounded, and the light showing a color picture is formed. It is projected on the compounded light by the incident-light study system 826 on a screen 827, and it has the structure where a picture is expanded and displayed.
[0004]
[Problem(s) to be Solved by the Invention] Since a means to carry out the spectrum of the light by which outgoing radiation was carried out from the light source to three colored light in the above-mentioned conventional projected type display using a dichroic mirror, to compound three colored light with a dichroic prism again after becoming irregular with three light modulation equipments different, respectively, and to form one image light was adopted, many optics were required and it was difficult to attain a miniaturization. Moreover, since light modulation equipment is directly irradiated after carrying out the spectrum of the light by which outgoing radiation is carried out from the light source in the conventional projected type display, using lamps, such as metal halide, as the light source, Depending on the emission spectrum of a lamp, while the brightness for every colored light is difficult a color saturation control An irregular color and brightness unevenness arise in the picture which it originates in the luminescence unevenness of the light source, brightness unevenness occurs within the flux of light of each colored light, and the illuminance of the colored light irradiated by light modulation equipment becomes uneven, consequently is displayed on a screen, and there is a possibility that display quality may deteriorate.
[0005] Then, this invention equalizes the illuminance of the colored light irradiated by light modulation equipment while being made in view of the above-mentioned situation and being able to attain the miniaturization of equipment, and it aims at offering the projected type display which was excellent in display quality.
[0006]
[Means for Solving the Problem] Two or more light sources with possible the projected type display of this invention carrying out outgoing radiation of the different colored light, respectively, One illuminance equalization means for equalizing the illuminance of each colored light by which outgoing radiation was carried out from two or more aforementioned light sources, While providing a light guide means to lead each colored light by which outgoing

radiation was carried out with two or more aforementioned light sources to the aforementioned illuminance equalization means, and one light modulation equipment which modulates each colored light by which the illuminance was equalized by the aforementioned illuminance equalization means The optical outgoing radiation control means which the timing which carries out outgoing radiation of the colored light from each light source is controlled, and can carry out outgoing radiation of the colored light one by one time from two or more aforementioned light sources, The light modulation equipment driving means which are made to correspond to the colored light by which outgoing radiation is carried out from each light source, and drive the aforementioned light modulation equipment one by one time, The synchronizing signal which synchronizes the timing which carries out outgoing radiation of the colored light from each light source, and the timing which drives the aforementioned light modulation equipment is generated, and it is characterized by providing a synchronizing signal generating means to input into the aforementioned optical outgoing radiation control means and the aforementioned light modulation equipment driving means.

[0007] That is, after leading each colored light by which outgoing radiation was carried out with two or more light sources to one illuminance equalization means by the light guide means using two or more light sources which can carry out outgoing radiation of the colored light which is different in this invention, respectively and equalizing the illuminance of each colored light by the same illuminance equalization means, it is considering as the composition which displays by modulating each colored light by which the illuminance was equalized with one light modulation equipment. Thus, since it is considering as the composition which equalizes the illuminance of each colored light by which outgoing radiation was carried out with two or more light sources by one illuminance equalization means in this invention While the brightness of two or more colored light can be set up independently respectively and color adjustment becomes easy The luminance distribution within the flux of light of each colored light can be equalized, it can prevent that an irregular color and brightness unevenness arise in the picture displayed on a screen, and the projected type display which was excellent in display quality can be offered.

[0008] Furthermore, the optical outgoing radiation control means which the timing which carries out outgoing radiation of the colored light from each light source is controlled by this invention, and can carry out outgoing radiation of the colored light one by one time from two or more light sources, The light modulation equipment driving means which are made to correspond to the colored light by which outgoing radiation is carried out from each light source, and drive light modulation equipment one by one time, It is considering as the composition possessing a synchronizing signal generating means to output the synchronizing signal which synchronizes the timing which carries out outgoing radiation of the colored light from each light source, and the timing which drives light modulation equipment to optical outgoing radiation control means and light modulation equipment driving means.

[0009] Namely, by synchronizing the timing which carries out time sharing of the one frame, is made to carry out outgoing radiation of the colored light one by one time from two or more light sources in this invention, and carries out outgoing radiation of the colored light from each light source, and the timing which drives light modulation equipment It is made to correspond to the colored light by which outgoing radiation is carried out from each light source, light modulation equipment is driven one by one time, and it is considering as the composition which compounds a color picture by outputting the picture signal corresponding to the colored light by which outgoing radiation is carried out from each light source. Thus, since it is not necessary to display by forming a pixel for every color by adopting the color order following drive method as a drive method of light modulation equipment, highly minute-ization of light modulation equipment can be attained, and the projected type display which was excellent in display quality can be offered.

[0010] Moreover, after carrying out the spectrum of the light by which outgoing radiation is carried out from this light source to two or more colored light using the one light source conventionally, As opposed to having become irregular with two or more light modulation equipments, having compounded the colored light of after that plurality again, and having displayed the picture in this invention Since the light modulation equipment with which the means which carries out a spectrum, and a means to re-compound two or more colored light are unnecessary to two or more colored light with equipment, and were conventionally prepared in it can be made into one piece, the optic to be used can be lessened and the miniaturization of equipment can be attained. [ two or more ]

[0011] In the projected type display of this invention, as the aforementioned illuminance equalization means, a rod lens or the fly eye lens of a couple can specifically be illustrated, and a dichroic prism can specifically be illustrated as the aforementioned light guide means. Moreover, specifically as colored light by which outgoing radiation is carried out with two or more aforementioned light sources, red light, green light, and a blue glow can be illustrated.

[0012]

[Embodiments of the Invention] Next, the operation gestalt concerning this invention is explained in full detail. Based on drawing 1 - drawing 5 , the structure of the projected type display of the operation gestalt concerning this invention is explained. The schematic diagram in which drawing 1 shows the whole projected type display 10 structure of this operation gestalt, the outline perspective diagram showing the example of 1 composition of the light source with which the projected type display 10 was equipped with drawing 2 , and which is mentioned later, The outline perspective diagram and outline cross section showing the structure of a rod lens (illuminance equalization means) mentioned later where the projected type display 10 was equipped with drawing 3 (a) and (b), Drawing and drawing 5 which show the example of others of an illuminance equalization means by which the projected type display 10 is equipped with drawing 4 are drawing showing the relation between the timing which carries out outgoing radiation of the colored light, and the timing which drives light modulation equipment from the light source in the projected type display 10 of this operation gestalt. In addition, the projected type display of this operation gestalt is an example, and this invention is not limited to this.

[0013] As shown in drawing 1 , the projected type display 10 of this operation gestalt The light sources 20R, 20G, and 20B which can carry out outgoing radiation of red light (R), green light (G), and the blue glow (B), respectively, The rod lens 30 for equalizing the illuminance of each colored light by which outgoing radiation was carried out from each light sources 20R, 20G, and 20B (illuminance equalization means), The light modulation equipment 40 which modulates each colored light by which the illuminance was equalized by the rod lens 30, and compounds a picture, The screen 60 which displays the picture expanded by the incident-light study system 50 and the incident-light study system 50 for carrying out expansion projection of the picture compounded by light modulation equipment 40 is constituted as a subject.

[0014] Each light sources 20R, 20G, and 20B consist of light emitting devices, such as light emitting diode which can emit light, respectively, and electroluminescence, in red light, green light, and the blue glow, and each light sources 20R, 20G, and 20B may consist of one light emitting device respectively, and two or more light emitting devices may be arranged in the shape of an array, as shown in drawing 2 . In addition, in drawing 2 , the sign 2 shows each light emitting device. Thus, as compared with the case where lamps, such as metal halide, are used as the light source, a life of a lamp can be lengthened like before by constituting each light sources 20R, 20G, and 20B by one piece or two or more light emitting devices. Moreover, since the array of a light emitting device etc. can be freely designed for every light source by arranging independently each light sources 20R, 20G, and 20B, the brightness of each colored light by which outgoing radiation is carried out from each light source can be adjusted freely.

[0015] It connects with the optical outgoing radiation control circuit (optical outgoing radiation control means) 70, the timing which carries out outgoing radiation of the colored light from each light sources 20R, 20G, and 20B is controlled by this optical outgoing radiation control circuit 70, and each light sources 20R, 20G, and 20B have structure which can carry out outgoing radiation of the colored light one by one time from the light sources 20R, 20G, and 20B.

[0016] The colored light by which outgoing radiation was carried out from each light sources 20R, 20G, and 20B is led to a rod lens 30 by the light guide means 22, after being condensed with the lenses 21R, 21G, and 21B prepared corresponding to each light source. The light guide means 22 has the structure where each colored light which consisted of a cross dichroic prism with which the dielectric multilayer which four rectangular prisms are stuck and reflects red light in the inside, and the dielectric multilayer which reflects a blue glow were formed in the shape of a cross joint, and carried out incidence from three different directions (illustration above, the illustration left, illustration down) is led to the rod lens 30 altogether located in the method of the illustration right by the light guide means 22.

[0017] As a rod lens 30 is shown in drawing 3 (a), the configuration is a rectangular parallelepiped-like and the optical plane of incidence 31 and the illustration right end have become [ the illustration left end of a rod lens 30 ] the optical outgoing radiation side 32. As shown in drawing 3 (b), the light which carried out incidence to the optical plane of incidence 31 from various directions goes straight on in a rod lens 30, or has on the side 1 time or structure by which multiple-times total reflection is carried out and outgoing radiation is carried out from the optical outgoing radiation side 32. And regardless of the density distribution of the light which carries out incidence to a rod lens 30, it has structure which can carry out outgoing radiation of the light by uniform density distribution from the whole surface of the optical outgoing radiation side 32, consequently can equalize the illuminance (luminance distribution) of light. In addition, as shown in drawing 1 , when the light guide means 22 consists of a cross dichroic prism, all the colored light by which outgoing radiation is carried out from the light guide means 22 can be led to a rod lens 30 by joining the optical outgoing radiation side of the light guide means 22 to the optical plane of incidence 31 of a rod lens 30.

[0018] Moreover, as an illuminance equalization means, as shown in drawing 4 other than a rod lens 30, the fly eye lenses 35 and 36 of the couple by which opposite arrangement was carried out at intervals of predetermined can also constitute. As shown in drawing 4 , after being condensed with each convex lens of the fly eye lens 35 on the left-hand side of illustration, the colored light by which outgoing radiation was carried out from the light guide means 22 by arranging the fly eye lenses 35 and 36 of the couple in which many convex lenses were arranged on the surface of one side so that a convex lens may counter mutually is diffused with each convex lens of the fly eye lens 36 on the right-hand side of illustration, and outgoing radiation is carried out. Thus, the illuminance of colored light can be equalized by passing the fly eye lenses 35 and 36 of a couple by piling up the light which passed each convex lens on light modulation equipment.

[0019] It is condensed through lenses 37 and 38 and each colored light by which outgoing radiation was carried out in the various directions with the uniform illuminance from the rod lens 30 (fly eye lenses 35 and 36) is irradiated by the light modulation equipment 40 which consists of liquid crystal equipment etc. In addition, in drawing 1 , although illustrated about the case where penetrated type light modulation equipment 40 is used, this invention is not limited to this and may use reflected type light modulation equipment. Light modulation equipment 40 is connected to the light modulation equipment drive circuit (light modulation equipment driving means) 80, and it has structure which it is made to correspond to each colored light by this light modulation equipment drive circuit 80, and can drive light modulation equipment 40 one by one time.

[0020] Moreover, in this operation gestalt, it has the synchronizing signal generating circuit (synchronizing signal generating means) 90, and has the structure where the timing which carries out outgoing radiation of the colored light, and the timing which drives light modulation equipment 40 can be synchronized from each light sources 20R, 20G, and 20B by generating a synchronizing signal SYNC and inputting into the optical outgoing radiation control circuit 70 and the light modulation equipment drive circuit 80 by this synchronizing signal generating circuit 90.

[0021] namely, in the projected type display 10 of this operation gestalt Time sharing of the one frame is carried out. one by one time from the light sources 20R, 20G, and 20B Red light, By synchronizing the timing which is made to carry out outgoing radiation of green light and the blue glow, and carries out outgoing radiation of the colored light from each light sources 20R, 20G, and 20B, and the timing which drives light modulation equipment 40 It is made to correspond to the colored light by which outgoing radiation is carried out from each light sources 20R, 20G, and 20B, light modulation equipment 40 is driven one by one time, and it has structure which can compound a color picture by outputting the picture signal corresponding to the colored light by which outgoing radiation is carried out from each light sources 20R, 20G, and 20B.

[0022] This is explained based on drawing 5 . As shown in drawing 5 , light modulation equipment 40 is driven according to the outgoing radiation timing of the light by which carries out time sharing of the one frame to three, and is made to carry out outgoing radiation of red light, a blue glow, and the green light one by one from the light sources 20R, 20G, and 20B, and outgoing radiation is carried out from the light sources 20R, 20G, and 20B, and the picture signal corresponding to the colored light by which outgoing radiation is carried out is outputted. Specifically, while outgoing radiation of the red light (R) is carried out by light source 20R, the picture signal SR corresponding to red light (R) is outputted by light modulation equipment 40. While outgoing radiation of green light (G) or the blue glow (B) is similarly carried out by light source 20G or 20B about green light and the blue glow, the picture signal SG or picture signal SB corresponding to green light (G) or the blue glow (B) is outputted by light modulation equipment 40. And it is possible for every frame to compound a color picture based on the picture signals SR, SG, and SB corresponding to red light, green light, and the blue glow. In addition, in drawing 5 , although the case where outgoing radiation of the colored light was carried out to the order of red light, green light, and a blue glow was explained, this invention is not limited to this and may carry out outgoing radiation of the colored light to what order.

[0023] Thus, since it is not necessary to display by forming a pixel for every color by adopting the color order following drive method as a drive method of light modulation equipment 40 according to this operation gestalt, highly minute-ization of light modulation equipment 40 can be attained, and the projected type display 10 which was excellent in display quality can be offered. Moreover, expansion projection of the color picture compounded by light modulation equipment 40 is carried out through the incident-light study system 50 which consists of a projector lens etc. at a screen 60, and a display is performed.

[0024] Since it is considering as the composition which equalizes the illuminance (luminance distribution) of each colored light by which outgoing radiation was carried out with two or more light sources 20R, 20G, and 20B by one illuminance equalization means (a rod lens 30 or fly eye lenses 35 and 36) according to this operation gestalt While being able to set up the brightness for every colored light independently, the luminance distribution within the flux of light of each colored light can be equalized, it can prevent that an irregular color and brightness unevenness arise in the picture displayed on a screen 60, and the projected type display 10 which was excellent in display quality can be offered.

[0025] Moreover, according to this operation gestalt, to having become irregular with two or more light modulation equipments, having compounded the colored light of after that plurality again, and having displayed the picture conventionally, after carrying out the spectrum of the light by which outgoing radiation is carried out from this light source to two or more colored light using the one light source Since the light modulation equipment with which the means which carries out a spectrum, and a means to re-compound two or more colored light are unnecessary to two or more colored light with equipment, and were conventionally prepared in it can be made into one piece, the optic to be used can be lessened and the miniaturization of equipment can be attained. [ two or more ]

[0026]

[Effect of the Invention] As mentioned above, two or more light sources which can carry out outgoing radiation of the different colored light, respectively according to this invention as explained in detail, One illuminance equalization means for equalizing the illuminance of each colored light by which outgoing radiation was carried out from two or more light sources, By considering as the composition which forms a light guide means to lead each colored light by which outgoing radiation was carried out with the light source to an illuminance equalization means, and one light modulation equipment which modulates each colored light by which the illuminance was equalized by the illuminance equalization means While being able to equalize the brightness for every colored light, the luminance distribution within the flux of light of each colored light can be equalized, it can prevent that an irregular color and brightness unevenness arise in the picture displayed on a screen, and the projected type display which was excellent in display quality can be offered.

[0027] Moreover, since the composition which displays by making it correspond to the colored light by which is made to carry out outgoing radiation of the colored light one by one time from two or more light sources, and outgoing radiation is carried out from each light source, and driving light modulation equipment one by one time is adopted according to this invention Since the light modulation equipment with which the means which carries out a spectrum, and a means to re-compound two or more colored light are unnecessary to two or more colored light with equipment, and were conventionally prepared in it can be made into one piece, the optic to be used can be lessened and the miniaturization of equipment can be attained. [ two or more ]

---

[Translation done.]

* NOTICES *

**Japan Patent Office is not responsible for any damages caused by the use of this translation.**

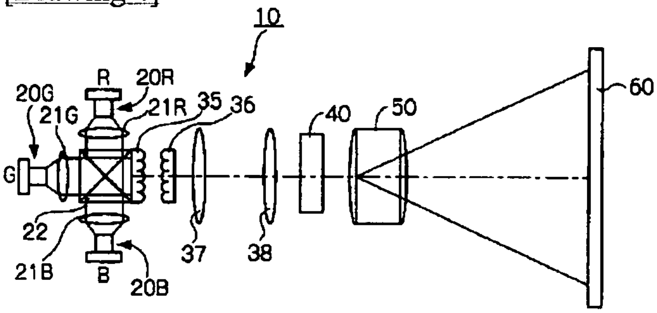
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

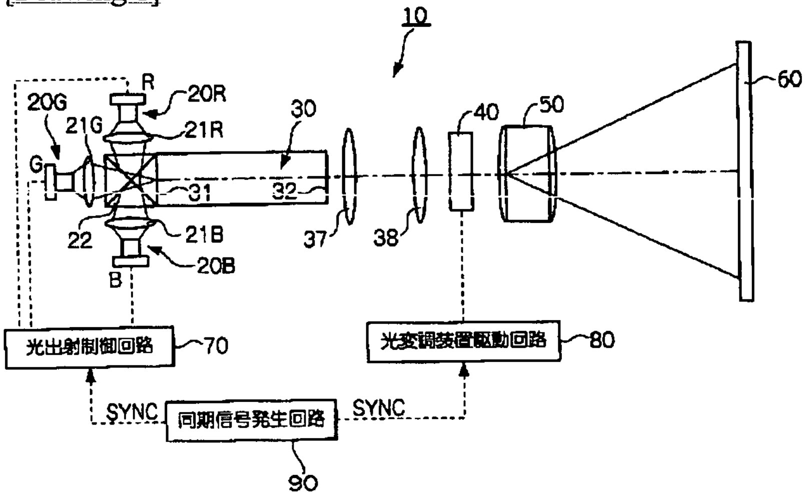
DRAWINGS

---

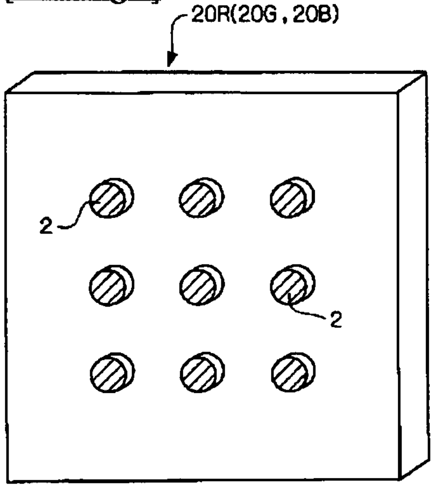
[Drawing 4]



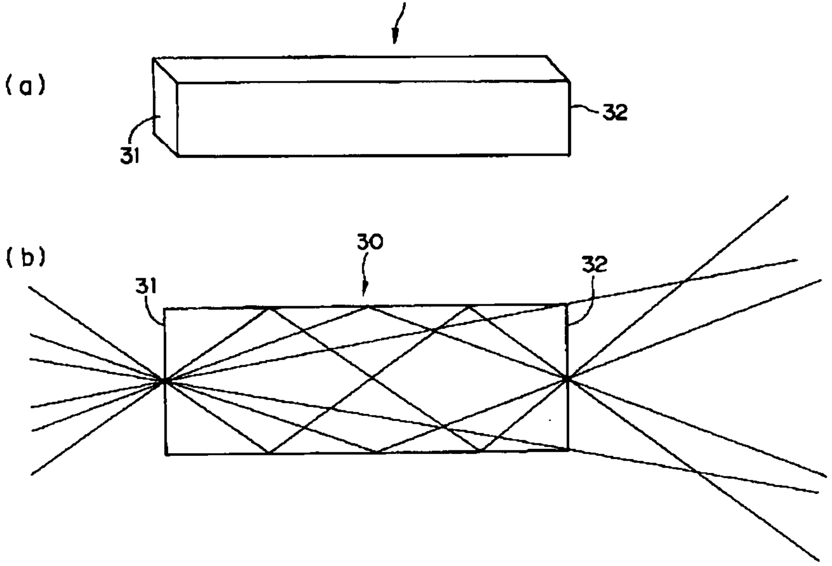
[Drawing 1]



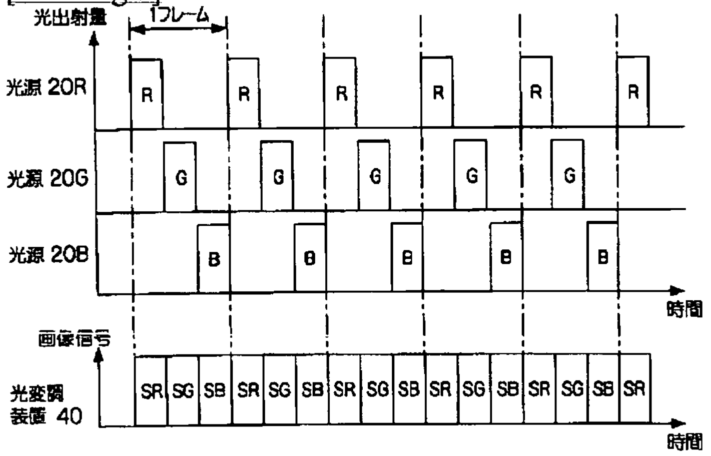
[Drawing 2]



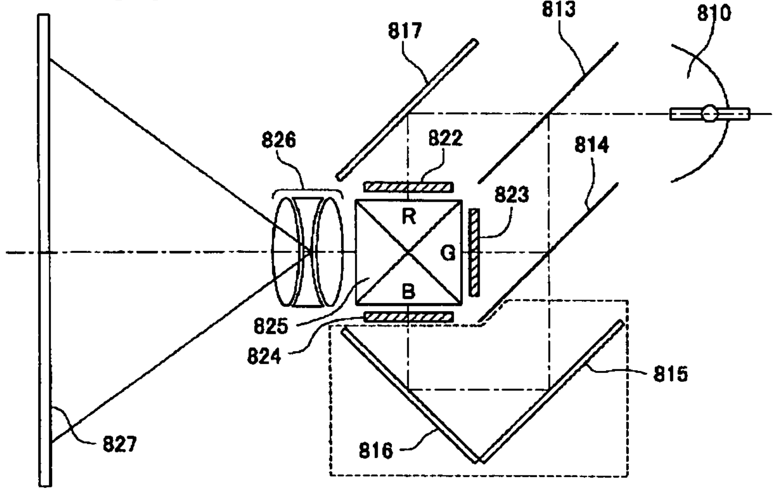
[Drawing 3]



[Drawing 5]



[Drawing 6]



---

[Translation done.]

(19)日本国特許庁（ＪＰ）

(12) **公開特許公報**（Ａ）

(11)特許出願公開番号
特開2002－189263
（P2002－189263A）

(43)公開日 平成14年7月5日(2002.7.5)

| (51)Int.Cl.$^7$ | 識別記号 | ＦＩ | テーマコード(参考) |
|---|---|---|---|
| Ｇ０３Ｂ 33/12 | | Ｇ０３Ｂ 33/12 | ２Ｈ０４２ |
| Ｇ０２Ｂ 3/00 | | Ｇ０２Ｂ 3/00 | Ａ |
| 5/04 | | 5/04 | Ｃ |
| Ｇ０３Ｂ 21/00 | | Ｇ０３Ｂ 21/00 | Ｄ |

審査請求 未請求 請求項の数４ ＯＬ （全 ７ 頁）

(21)出願番号 特願2000－388800(P2000－388800)

(22)出願日 平成12年12月21日(2000.12.21)

(71)出願人 000002369
セイコーエプソン株式会社
東京都新宿区西新宿２丁目４番１号

(72)発明者 坂田 秀文
長野県諏訪市大和３丁目３番５号 セイコーエプソン株式会社内

(74)代理人 100089037
弁理士 渡邉 隆 (外３名)

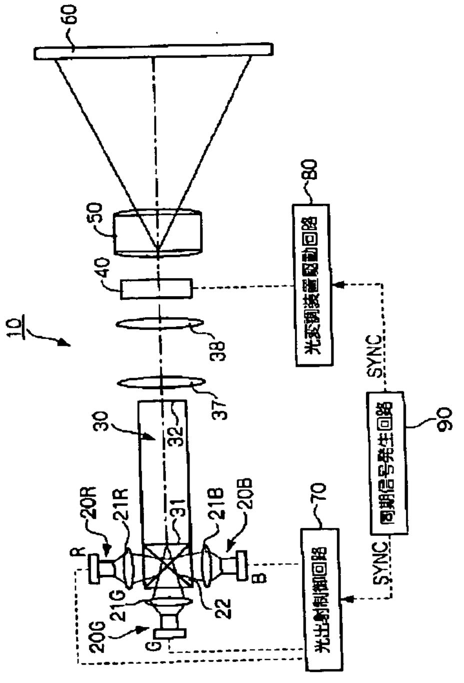
Ｆターム(参考) 2H042 CA08 CA17

## (54)【発明の名称】 投射型表示装置

(57)【要約】

【課題】 装置の小型化を図ることができるとともに、光変調装置に照射される色光の照度（輝度分布）を均一化し、表示品質の優れた投射型表示装置を提供する。

【解決手段】 投射型表示装置１０は、異なる複数の色光をそれぞれ出射する光源２０Ｒ、２０Ｇ、２０Ｂと、各光源２０Ｒ、２０Ｇ、２０Ｂから出射された各色光の照度を均一化する１個のロッドレンズ（照度均一化手段）３０と、光源２０Ｒ、２０Ｇ、２０Ｂにより出射された各色光をロッドレンズ３０に導く導光手段２２と、ロッドレンズ３０により照度が均一化された各色光を変調する１個の光変調装置４０とを具備し、光源２０Ｒ、２０Ｇ、２０Ｂから時間順次に色光を出射させ、各光源２０Ｒ、２０Ｇ、２０Ｂから出射される色光に対応させて光変調装置４０を時間順次に駆動してカラー画像の合成を行う。



【特許請求の範囲】

【請求項１】　異なる色光をそれぞれ出射することが可能な複数の光源と、前記複数の光源から出射された各色光の照度を均一化するための１個の照度均一化手段と、前記複数の光源により出射された各色光を前記照度均一化手段に導く導光手段と、前記照度均一化手段により照度が均一化された各色光を変調する１個の光変調装置とを具備するとともに、

各光源から色光を出射するタイミングを制御し、前記複数の光源から時間順次に色光を出射させることが可能な光出射制御手段と、

各光源から出射される色光に対応させて前記光変調装置を時間順次に駆動する光変調装置駆動手段と、

各光源から色光を出射するタイミングと前記光変調装置を駆動するタイミングとを同期させる同期信号を発生し、前記光出射制御手段及び前記光変調装置駆動手段に入力する同期信号発生手段とを具備することを特徴とする投射型表示装置。

【請求項２】　前記照度均一化手段がロッドレンズあるいは一対のフライアイレンズからなることを特徴とする請求項１に記載の投射型表示装置。

【請求項３】　前記導光手段がダイクロイックプリズムからなることを特徴とする請求項１又は請求項２に記載の投射型表示装置。

【請求項４】　前記複数の光源により出射される色光が、赤色光、緑色光、青色光であることを特徴とする請求項１から請求項３までのいずれか１項に記載の投射型表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、投射型表示装置に関するものである。

【０００２】

【従来の技術】光変調装置として液晶装置等を用いて映像光を合成し、合成された映像光を投射レンズ等からなる投射光学系を介してスクリーンに拡大投影する投射型表示装置が知られている。図６に基づいて、従来の投射型表示装置の構造について説明する。図６において、８１０はメタルハライド等のランプからなる光源、８１３、８１４はダイクロイックミラー、８１５、８１６、８１７は反射ミラー、８２２、８２３、８２４は光変調装置、８２５はダイクロイックプリズム、８２６は投射光学系を示す。

【０００３】ダイクロイックミラー８１３は、赤色光を透過するとともに、青色光と緑色光とを反射する性質を有し、光源８１０から出射された光のうち、ダイクロイックミラー８１３を透過した赤色光は反射ミラー８１７で反射されて、赤色光用光変調装置８２２に入射する。一方、ダイクロイックミラー８１３で反射された色光のうち緑色光は、緑色光を反射するダイクロイックミラー８１４によって反射され、緑色光用光変調装置８２３に入射し、青色光はダイクロイックミラー８１４も透過し、反射ミラー８１５、８１６で反射された後、青色光用光変調装置８２４に入射する。各光変調装置により変調された３つの色光はダイクロイックプリズム８２５に入射し、３つの色光が合成されて、カラー画像を表す光が形成される。合成された光は、投射光学系８２６によりスクリーン８２７上に投射され、画像が拡大されて表示される構造になっている。

【０００４】

【発明が解決しようとする課題】上記従来の投射型表示装置においては、光源から出射された光をダイクロイックミラーを用いて３つの色光に分光し、それぞれ異なる３個の光変調装置によって変調した後、再びダイクロイックプリズムによって３つの色光を合成して１つの映像光を形成する手段を採用しているため、多数の光学部品が必要であり、小型化を図ることが困難であった。また、従来の投射型表示装置においては、メタルハライド等のランプを光源として用い、光源から出射される光を分光した後、直接、光変調装置に照射しているため、色光ごとの輝度がランプの発光スペクトルに依存してしまい、色調節が困難であるとともに、光源の発光むらに起因して、各色光の光束内で輝度むらが発生し、光変調装置に照射される色光の照度が不均一となり、その結果、スクリーンに表示される画像に色むらや輝度むらが生じ、表示品質が悪化する恐れがある。

【０００５】そこで、本発明は上記事情に鑑みてなされたもので、装置の小型化を図ることができるとともに、光変調装置に照射される色光の照度を均一化し、表示品質の優れた投射型表示装置を提供することを目的とする。

【０００６】

【課題を解決するための手段】本発明の投射型表示装置は、異なる色光をそれぞれ出射することが可能な複数の光源と、前記複数の光源から出射された各色光の照度を均一化するための１個の照度均一化手段と、前記複数の光源により出射された各色光を前記照度均一化手段に導く導光手段と、前記照度均一化手段により照度が均一化された各色光を変調する１個の光変調装置とを具備するとともに、各光源から色光を出射するタイミングを制御し、前記複数の光源から時間順次に色光を出射させることが可能な光出射制御手段と、各光源から出射される色光に対応させて前記光変調装置を時間順次に駆動する光変調装置駆動手段と、各光源から色光を出射するタイミングと前記光変調装置を駆動するタイミングとを同期させる同期信号を発生し、前記光出射制御手段及び前記光変調装置駆動手段に入力する同期信号発生手段とを具備することを特徴とする。

【０００７】すなわち、本発明では異なる色光をそれぞれ出射することが可能な複数の光源を用い、複数の光源

により出射された各色光を導光手段により、１個の照度均一化手段に導き、同一の照度均一化手段により、各色光の照度を均一化した後、照度が均一化された各色光を１個の光変調装置により変調させて表示を行う構成としている。このように、本発明では、複数の光源により出射された各色光の照度を１個の照度均一化手段により均一化する構成としているので、複数の色光の輝度を各々独立に設定することができ、色調整が容易となるとともに、各色光の光束内における輝度分布を均一化することができ、スクリーンに表示される画像に色むらや輝度むらが生じることを防止し、表示品質の優れた投射型表示装置を提供することができる。

【０００８】さらに、本発明では、各光源から色光を出射するタイミングを制御し、複数の光源から時間順次に色光を出射させることが可能な光出射制御手段と、各光源から出射される色光に対応させて光変調装置を時間順次に駆動する光変調装置駆動手段と、各光源から色光を出射するタイミングと光変調装置を駆動するタイミングとを同期させる同期信号を、光出射制御手段及び光変調装置駆動手段に出力する同期信号発生手段とを具備する構成としている。

【０００９】すなわち、本発明では、１フレームを時分割し、複数の光源から時間順次に色光を出射させ、各光源から色光を出射するタイミングと光変調装置を駆動するタイミングとを同期させることにより、各光源から出射される色光に対応させて光変調装置を時間順次に駆動し、各光源から出射される色光に対応する画像信号を出力することにより、カラー画像を合成する構成としている。このように、光変調装置の駆動方式として色順次駆動方式を採用することにより、色毎に画素を形成して表示を行う必要がないので、光変調装置の高精細化を図ることができ、表示品質の優れた投射型表示装置を提供することができる。

【００１０】また、従来は１個の光源を用い、この光源から出射される光を複数の色光に分光した後、複数の光変調装置で変調し、その後複数の色光を再度合成して画像を表示していたのに対し、本発明では、複数の色光に分光する手段や、複数の色光を再合成する手段が不要であり、また、従来複数設けられていた光変調装置を１個にすることができるので、使用する光学部品を少なくすることができ、装置の小型化を図ることができる。

【００１１】本発明の投射型表示装置において、前記照度均一化手段としては、具体的にはロッドレンズあるいは一対のフライアイレンズを例示することができ、また、前記導光手段としては、具体的にはダイクロイックプリズムを例示することができる。また、前記複数の光源により出射される色光としては、具体的には、赤色光、緑色光、青色光を例示することができる。

【００１２】

【発明の実施の形態】次に、本発明に係る実施形態について詳述する。図１～図５に基づいて、本発明に係る実施形態の投射型表示装置の構造について説明する。図１は本実施形態の投射型表示装置１０の全体構造を示す概略図、図２は投射型表示装置１０に備えられた後述する光源の一構成例を示す概略斜視図、図３（ａ）、（ｂ）は投射型表示装置１０に備えられた後述するロッドレンズ（照度均一化手段）の構造を示す概略斜視図及び概略断面図、図４は投射型表示装置１０に備えられる照度均一化手段のその他の例を示す図、図５は本実施形態の投射型表示装置１０における、光源から色光を出射するタイミングと、光変調装置を駆動するタイミングとの関係を示す図である。なお、本実施形態の投射型表示装置は一例であって、本発明はこれに限定されるものではない。

【００１３】図１に示すように、本実施形態の投射型表示装置１０は、赤色光（Ｒ）、緑色光（Ｇ）、青色光（Ｂ）をそれぞれ出射することが可能な光源２０Ｒ、２０Ｇ、２０Ｂと、各光源２０Ｒ、２０Ｇ、２０Ｂから出射された各色光の照度を均一化するためのロッドレンズ（照度均一化手段）３０と、ロッドレンズ３０により照度が均一化された各色光を変調して、画像を合成する光変調装置４０と、光変調装置４０により合成された画像を拡大投影するための投射光学系５０と、投射光学系５０により拡大された画像を表示するスクリーン６０とを主体として構成されている。

【００１４】各光源２０Ｒ、２０Ｇ、２０Ｂは、赤色光、緑色光、青色光をそれぞれ発光することが可能な発光ダイオードやエレクトロルミネッセンス等の発光素子から構成されており、各光源２０Ｒ、２０Ｇ、２０Ｂは各々１個の発光素子から構成されていてもよいし、複数の発光素子が、例えば図２に示すようにアレイ状に配列されたものであってもよい。なお、図２において、各発光素子を符号２で示している。このように、各光源２０Ｒ、２０Ｇ、２０Ｂを１個若しくは複数の発光素子により構成することにより、従来のように、光源としてメタルハライド等のランプを用いる場合に比較して光源の寿命を長くすることができる。また、各光源２０Ｒ、２０Ｇ、２０Ｂを独立に配置させることにより、光源ごとに発光素子の配列等を自由に設計することができるので、各光源から出射される各色光の輝度を自由に調節することができる。

【００１５】各光源２０Ｒ、２０Ｇ、２０Ｂは、光出射制御回路（光出射制御手段）７０に接続されており、この光出射制御回路７０により、各光源２０Ｒ、２０Ｇ、２０Ｂから色光を出射するタイミングが制御され、光源２０Ｒ、２０Ｇ、２０Ｂから時間順次に色光を出射させることが可能な構造になっている。

【００１６】各光源２０Ｒ、２０Ｇ、２０Ｂから出射された色光は、各光源に対応して設けられたレンズ２１Ｒ、２１Ｇ、２１Ｂにより集光された後、導光手段２２

によりロッドレンズ３０に導かれる。導光手段２２は、例えば、４つの直角プリズムが貼り合わされ、その内面に赤色光を反射する誘電体多層膜と青色光を反射する誘電体多層膜とが十字状に形成されたクロスダイクロイックプリズムからなり、異なる３方向（図示上方向、図示左方向、図示下方向）から入射した各色光は導光手段２２により、すべて図示右方に位置するロッドレンズ３０に導かれる構造になっている。

【００１７】ロッドレンズ３０は図３（ａ）に示すように、その形状は直方体状であり、ロッドレンズ３０の図示左端が光入射面３１、図示右端が光出射面３２になっている。図３（ｂ）に示すように、種々の方向から光入射面３１に入射した光はロッドレンズ３０内において、直進して、あるいは側面で１回若しくは複数回全反射されて、光出射面３２から出射される構造になっている。そして、ロッドレンズ３０に入射する光の密度分布に関係なく、光出射面３２の全面から均一な密度分布で光を出射することができ、その結果、光の照度（輝度分布）を均一化することができる構造になっている。なお、図１に示すように、導光手段２２がクロスダイクロイックプリズムからなる場合には、導光手段２２の光出射面をロッドレンズ３０の光入射面３１に接合させることにより、導光手段２２から出射される色光をすべてロッドレンズ３０に導くことができる。

【００１８】また、照度均一化手段としては、ロッドレンズ３０の他に、図４に示すように、所定間隔で対向配置された一対のフライアイレンズ３５、３６により構成することもできる。図４に示すように、一方の表面に多数の凸状レンズが配設された一対のフライアイレンズ３５、３６を、凸状レンズが互いに対向するように配置させることにより、導光手段２２から出射された色光は、図示左側のフライアイレンズ３５の各凸状レンズにより集光された後、図示右側のフライアイレンズ３６の各凸状レンズにより拡散されて出射される。このように一対のフライアイレンズ３５、３６を通過させることにより、各凸状レンズを通過した光を光変調装置上で重ね合わせることで色光の照度を均一化することができる。

【００１９】ロッドレンズ３０（フライアイレンズ３５、３６）から種々の方向に均一な照度で出射された各色光は、レンズ３７、３８を介して集光され、液晶装置などからなる光変調装置４０に照射される。なお、図１においては、透過型の光変調装置４０を用いた場合について図示しているが、本発明はこれに限定されるものではなく、反射型の光変調装置を用いても良い。光変調装置４０は光変調装置駆動回路（光変調装置駆動手段）８０に接続されており、この光変調装置駆動回路８０により各色光に対応させて光変調装置４０を時間順次に駆動することが可能な構造になっている。

【００２０】また、本実施形態において、同期信号発生回路（同期信号発生手段）９０が備えられており、この

同期信号発生回路９０により、同期信号ＳＹＮＣを発生させ、光出射制御回路７０及び光変調装置駆動回路８０に入力することにより、各光源２０Ｒ、２０Ｇ、２０Ｂから色光を出射するタイミングと光変調装置４０を駆動するタイミングとを同期させることができる構造になっている。

【００２１】すなわち、本実施形態の投射型表示装置１０では、１フレームを時分割し、光源２０Ｒ、２０Ｇ、２０Ｂから時間順次に赤色光、緑色光、青色光を出射させ、各光源２０Ｒ、２０Ｇ、２０Ｂから色光を出射するタイミングと光変調装置４０を駆動するタイミングとを同期させることにより、各光源２０Ｒ、２０Ｇ、２０Ｂから出射される色光に対応させて光変調装置４０を時間順次に駆動し、各光源２０Ｒ、２０Ｇ、２０Ｂから出射される色光に対応する画像信号を出力することにより、カラー画像を合成することが可能な構造になっている。

【００２２】このことを図５に基づいて説明する。図５に示すように、１フレームを３つに時分割し、光源２０Ｒ、２０Ｇ、２０Ｂから順次赤色光、青色光、緑色光を出射させ、光源２０Ｒ、２０Ｇ、２０Ｂから出射される光の出射タイミングに合わせて光変調装置４０を駆動し、出射される色光に対応した画像信号を出力する。具体的には、光源２０Ｒにより赤色光（Ｒ）が出射されている間には、光変調装置４０により、赤色光（Ｒ）に対応した画像信号ＳＲが出力される。緑色光、青色光についても同様に、光源２０Ｇあるいは２０Ｂにより、緑色光（Ｇ）あるいは青色光（Ｂ）が出射されている間には、光変調装置４０により、緑色光（Ｇ）あるいは青色光（Ｂ）に対応した画像信号ＳＧあるいは画像信号ＳＢが出力される。そして、１フレームごとに、赤色光、緑色光、青色光に対応した画像信号ＳＲ、ＳＧ、ＳＢに基づいてカラー画像を合成することが可能になっている。なお、図５においては、赤色光、緑色光、青色光の順に、色光を出射させる場合について説明したが、本発明はこれに限定されるものではなく、どのような順に色光を出射させてもよい。

【００２３】このように、本実施形態によれば、光変調装置４０の駆動方式として色順次駆動方式を採用することにより、色毎に画素を形成して表示を行う必要がないので、光変調装置４０の高精細化を図ることができ、表示品質の優れた投射型表示装置１０を提供することができる。また、光変調装置４０により合成されたカラー画像は、投射レンズ等からなる投射光学系５０を介してスクリーン６０に拡大投影され、表示が行われる。

【００２４】本実施形態によれば、複数の光源２０Ｒ、２０Ｇ、２０Ｂにより出射された各色光の照度（輝度分布）を１個の照度均一化手段（ロッドレンズ３０あるいはフライアイレンズ３５、３６）により均一化する構成としているので、色光ごとの輝度を独立に設定することができるとともに、各色光の光束内における輝度分布を

均一化することができ、スクリーン６０に表示される画像に色むらや輝度むらが生じることを防止し、表示品質の優れた投射型表示装置１０を提供することができる。

【００２５】また、従来は１個の光源を用い、この光源から出射される光を複数の色光に分光した後、複数の光変調装置で変調し、その後複数の色光を再度合成して画像を表示していたのに対し、本実施形態によれば、複数の色光に分光する手段や、複数の色光を再合成する手段が不要であり、また、従来複数設けられていた光変調装置を１個にすることができるので、使用する光学部品を少なくすることができ、装置の小型化を図ることができる。

【００２６】

【発明の効果】以上、詳細に説明したように、本発明によれば、異なる色光をそれぞれ出射することが可能な複数の光源と、複数の光源から出射された各色光の照度を均一化するための１個の照度均一化手段と、光源により出射された各色光を照度均一化手段に導く導光手段と、照度均一化手段により照度が均一化された各色光を変調する１個の光変調装置とを設ける構成とすることにより、色光ごとの輝度を均一化することができるとともに、各色光の光束内における輝度分布を均一化することができ、スクリーンに表示される画像に色むらや輝度むらが生じることを防止し、表示品質の優れた投射型表示装置を提供することができる。

【００２７】また、本発明によれば、複数の光源から時間順次に色光を出射させ、各光源から出射される色光に対応させて光変調装置を時間順次に駆動して、表示を行う構成を採用しているので、複数の色光に分光する手段や、複数の色光を再合成する手段が不要であり、また、従来複数設けられていた光変調装置を１個にすることができるので、使用する光学部品を少なくすることができ、装置の小型化を図ることができる。

【図面の簡単な説明】

【図１】　図１は、本発明に係る実施形態の投射型表示

装置の全体構造を示す概略図である。

【図２】　図２は、本発明に係る実施形態の投射型表示装置に備えられた光源の一構成例を示す概略斜視図である。

【図３】　図３（ａ）、（ｂ）は、本発明に係る実施形態の投射型表示装置に備えられたロッドレンズ（照度均一化手段）の構造を示す概略斜視図及び概略断面図である。

【図４】　図４は、本発明に係る実施形態の投射型表示装置に備えられる照度均一化手段のその他の例を示す図である。

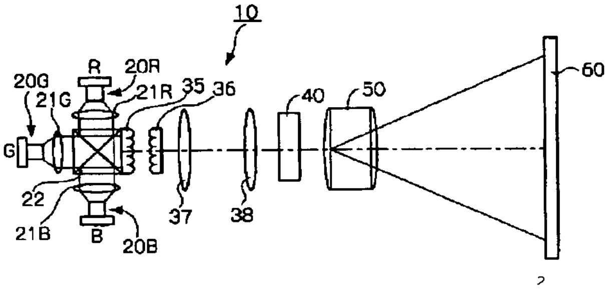
【図５】　図５は、本発明に係る実施形態の投射型表示装置における、光源から色光を出射するタイミングと、光変調装置を駆動するタイミングとの関係を示す図である。

【図６】　図６は、従来の投射型表示装置の構造を示す概略断面図である。

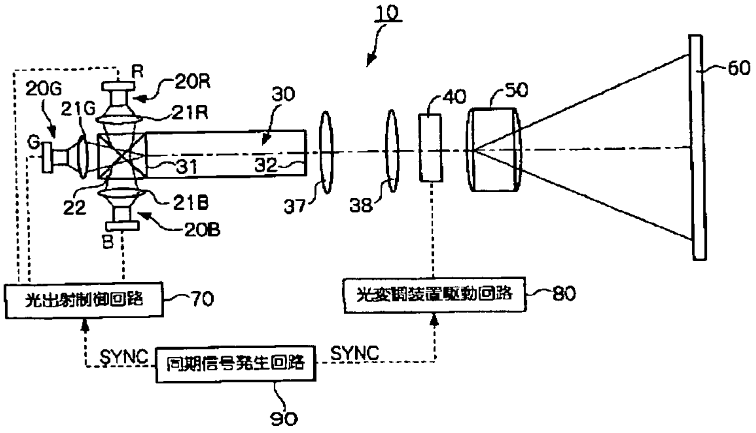
【符号の説明】

| | |
|---|---|
| １０ | 投射型表示装置 |
| ２０Ｒ、２０Ｇ、２０Ｂ | 光源 |
| ２２ | 導光手段 |
| ３０ | ロッドレンズ（照度均一化手段） |
| ３５、３６ | フライアイレンズ（照度均一化手段） |
| ４０ | 光変調装置 |
| ５０ | 投射光学系 |
| ６０ | スクリーン |
| ７０ | 光出射制御回路（光出射制御手段） |
| ８０ | 光変調装置駆動回路（光変調装置駆動手段） |
| ９０ | 同期信号発生回路（同期信号発生手段） |

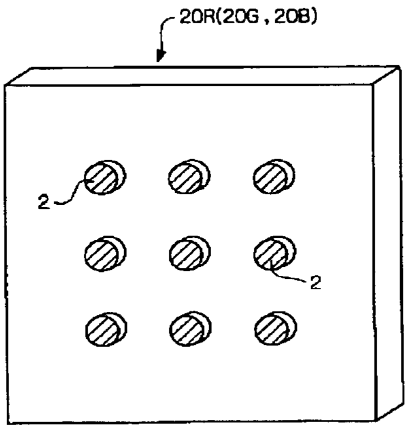
【図４】



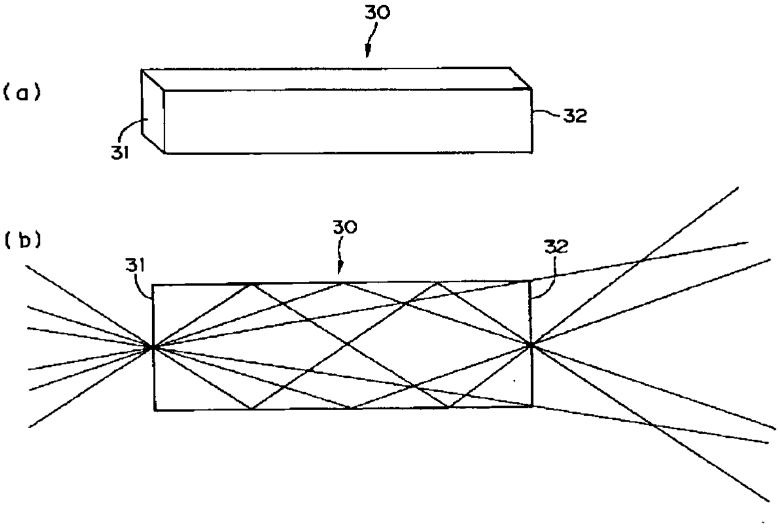
【図１】


10
R
20R
20G
21G
21R
30
40
50
60
G
31
32
22
21B
20B
B
37
38
光出射制御回路
70
光変調装置駆動回路
80
SYNC
同期信号発生回路
SYNC
90

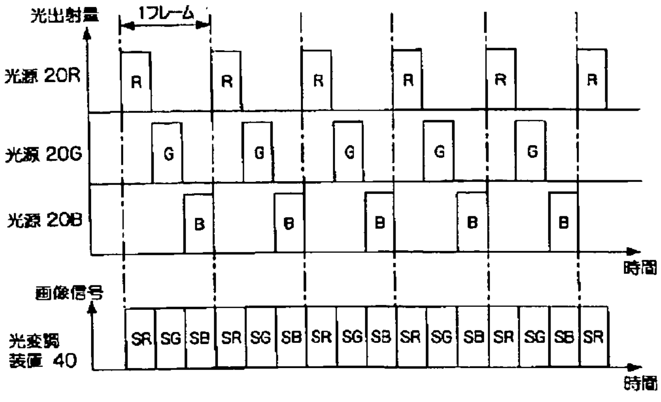
【図２】


20R(20G，20B)
2
2

【図３】


(a)
30
31
32
(b)
30
31
32

【図５】


光出射量
1フレーム
光源 20R
R
R
R
R
R
R
光源 20G
G
G
G
G
G
光源 20B
B
B
B
B
B
時間
画像信号
光変調装置 40
SR
SG
SB
SR
SG
SB
SR
SG
SB
SR
SG
SB
SR
SG
SB
SR
時間

【図６】